Max Hirschberger (The University of Tokyo)

"Spirals and skyrmions in magnets and their emergent electromagnetism"

Spirals and skyrmion textures are complex magnetic states in solids which, through coupling to the Fermi sea, may generate fascinating non-dissipative electromagnetic responses. A unified description is currently being developed through the concept of quantum-mechanical Berry curvature, in this case corresponding to an emergent magnetic field $\boldsymbol{\Omega}_{\mathbf{k}}$ living in reciprocal space (***k***-space).

We used extensive material search, as well as transport and resonant x-ray scattering experiments, to identify a new, centrosymmetric family of rare earth intermetallics with spirals and skyrmion spin-vortices of very short characteristic length scale (<5 nanometers) [1,2].

In the model compound Gd_2PdSi_3, $\boldsymbol{\Omega}_{\mathbf{k}}$ is shown to arise from a combination of canted spin texture and degeneracies in ***k***-space [3]. Moreover, spin-dynamics induced by an applied AC current in the related material $Gd_3Ru_4Al_{12}$ generate a phase-shifted voltage. This emergent inductance grows as the lateral dimensions of the sample become smaller and smaller – contrary to the case of, e.g., a classical coil-based inductor [4].

[1] T. Kurumaji *et al.*, Science 365, 914-918 (2019)
[2] M.H. *et al.*, Nat. Commun. 10, 5831 (2019)
[3] M.H. *et al.*, Phys. Rev. Lett. 125, 076602 (2020)
[4] T. Yokouchi *et al.*, Nature 586, 232–236 (2020)

Online via Zoom: Friday, 21.05.2021, 10:00 h:

https://uni-augsburg.zoom.us/j/92663648615?pwd=anFzSW9tUmxJTE1zZ0FKVzVaWitrUT09

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